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Classification of Fruits and Vegetables with its Nutrients

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Abstract - Computer vision dietary assessment systems that can record real-time images of food and analyze it for nutritional content can be convenient and improve the dietary habits, and therefore, result in a healthy life. In this project, we propose a new system to automatically estimate food attributes such as ingredients and nutritional value by classifying the input image of food.

***Key Words*: Convolutional Neural Networks, Tensor Flow, Object Detection, Deep Learning, Image Recognition, Nutrition Prediction, Android Studio, Open CV.**

1.INTRODUCTION

Consumption of fruits in day-to-day dietary plays an important role in the nutritional supplement intake of humans. Estimation of right nutrient intake through fruits consumption has become increasingly significant in order to maintain the proper health of the well-being. Recommendations on the choice of fruits being consumed have been vital in this process which can be accomplished through a specialized system. In this paper, the emphasis is given on the development of the strategies that can perform classification of fruits and suggest recommendations regarding the nutrition details of the fruits. Computer vision has its wide applications in the area automatic object recognition and classification; detection of a particular fruit type from the image of the same is the objective of the computer vision systems today. However, the intensive computational procedures involved in this process are currently being replaced by deep learning procedures due to wide recognition in terms of performance and reliability of the outcomes achieved. Quite a good amount of research is being carried out in this area, few reports depict the fruit detection based on the color, based on the size and shape, based on the geometrical and statistical properties of the fruit, and others include the decomposition of objects in varied levels through wavelets. The recognition and classification of the fruits have several benefits that include agriculture, industrial inspection, automated fruit segregation systems, nutrition prediction based on the images of fruits. Thus, fruit recognition and classification systems are employed in various fields and can be integrated with the latest technology for day to day.

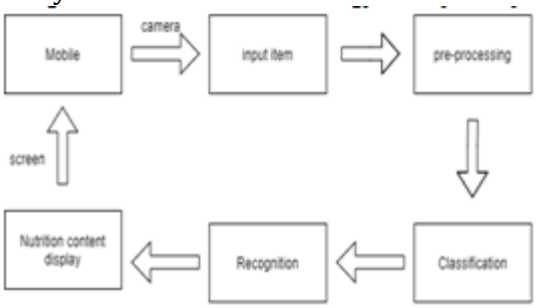

Fig 1: Block Diagram

The proposed system consists of two stages, first one is the recognition of the fruit type, and the second one is the nutritional value prediction. The above block diagram (Fig. 1) gives an idea of the proposed system. Firstly the image is fed to the system for preprocessing. Preprocessing steps include RGB to grayscale conversion, filtering, and resizing the image to 160 ×160 pixels. Segmentation is a technique that aims at identification and extraction of four ground object from an image resulting in individual segments. Classification is done with the help of CNN. The network would classify the input image into one of the predefined classes. Fruit type recognition if followed by classification. Based on fruit type, the nutrition values will be shown.

2. RELATED WORK

1. By- B. DivyaShree, R. Brunda and N. Shobha Rani in 2019:This paper introduces a basic and productive way to deal with perform organic product identification and foresee sustenance data of the natural products utilizing profound Alex systems (DAN). The aftereffects

of examination demonstrate that organic product identification utilizing DAN is proficient with a precision of about 91% to order the products of around 50 distinct classes on a solitary machine of setups 1 GPU, 8 GB RAM, and octa-center processor.

2. By- Xiuhua Liang, Guangming Deng, Bin Yan. Received 10 July 2015; accepted 21 August 2015; Published 24 August 2015:Using head segment examination (PCA) and group investigation, this paper displays a straightforward method to assess the extravagance of its nourishment as per the score of sustenance of leafy foods, at long last equal substitution proposals are given in various periods of vegetables and organic products as indicated by the consequence of bunching.

3. By- Manpreetkour Basantsingh Sardar1 , Dr. Sayyad D. Ajij2 1 PG Research Student, Electronics and Telecommunication Engineering, Maharashtra Institute of Technology, Aurangabad, India. International Journal Of Engineering And Computer Science ISSN: 2319-7242 Volume 5 Issue 10 Oct.2016:This paper proposes a calculation for organic product acknowledgment and its calorie estimation dependent on the shape, shading and surface alongside histogram of angles and GLCM with nearby double example calculations for surface division conspire perceiving the foods grown from the ground, significant pivot , minor hub are determined by utilizing shape highlight to get progressively precise calorie esteem. With the assistance of dietary look into table these highlights are encouraged to multi SVM classifier for exact characterization. Assessment is acted in MATLAB programming utilizing two database to be specific constant database and phony plastic organic product database. Results acquired are extremely near genuine calories of the natural product.

4.By-AnujaBhargava, Atul Bansal. Article info::Received 7 March 2018, Revised 1 May2018, Accepted3June2018: This paper speaks to a detailed extraction, grouping which tended tofoods grown from the ground quality dependent on shading,surface, size, shape and imperfections. Right now, basic correlation of various calculation proposed by specialists for quality review of leafy foods has been completed.

5. By Sophie Laura Holzmann, Katharina Pröll, Hans Hauner, Christina Holzapfel:There is a huge determination of sustenance (applications) which are utilized for self-following and as instructional apparatuses for a sound eating regimen. These applications offer an incredible assortment of capacities extending from keeping nourishment journals to giving cement healthful proposals. Until this point in time, there are not many perceived and institutionalized criteria for assessing sustenance applications. The applications analyzed right now constrained as far as characterized capacities and nature of data.

6. By Gianluigi Ciocca, Paolo Napoletano, and Raim:We propose another dataset for the assessment of nourishment acknowledgment calculations that can be utilized in dietary observing applications. Each picture delineates a genuine bottle plate with dishes and nourishments masterminded in various manners. Every plate contains numerous occasions of nourishment classes. We have explored different avenues regarding three diverse grouping techniques utilizing likewise a few visual descriptors. We accomplish about 79% of nourishment and plate acknowledgment exactness utilizing convolutional-neural-systems based highlights. The dataset, just as the benchmark structure, are accessible to the exploration network.

7. By Xiang Chen , Shixin Gu:We present our calorie estimation technique right now. To appraise calorie of nourishment, a top view and side view is required. Quicker R-CNN is utilized to identify the nourishment and alignment object. GrabCut calculation is utilized to get every nourishment's form. At that point the volume is assessed with the nourishment and relating object. At last we gauge every nourishment's calorie. Also, the examination results show our estimation strategy is compelling.

8. By Dheeraj Belliappa K S, Karan Vikram Singh Bhatia, Fathima Seher, Chinmita Shetty:Right now, proposed to make this strategy progressively splendid, speedier, and increasingly capable by building an electronic gadget that can exhibit the sustenance information by

simply snapping a picture of the feast. Utilizing Raspberry Pi board as the center preparing unit of the entire framework a Weight sensor, HX711 Burden Cell Module and a 5MP Raspberry Pi camera appended to the keen fork gathers information and transmits it to a nourishment database where it is contrasted and predefined nourishment esteems and counts the picture utilizing a picture handling strategy onMatlab stage. The information is appeared as calorie, fat, starch, and protein per serving. Using this application, customers can get the empowering information just by snapping a picture of the nourishment and not withstanding cooking strategies to realize precisely how much calories are being used.

9. By Shota Horiguchi, Member, Sosuke Amano, Makotto Ogawa, and Kiyoharu Aizawa: Right now personalization system which is a blend of the closest class mean classifier and the 1-closest neighbour classifier dependent on profound highlights. To direct reasonable tests, we utilized another dataset of day by day nourishment pictures gathered by a nourishment logging application. Test results show that our proposed technique essentially beats existing strategies.

10. By V.Hemalatha Reddy, Soumya Kumari,Vinitha Muralidharan, Karan Gigoo , Bhushan : Right now, have overviewed various techniques for nourishment acknowledgment and calorie estimation utilizing different strategies and looked at their exhibitions dependent few elements.

3. PROPOSED SYSTEM METHODOLOGY

A. Deep Learning:

Deep learning is a class of machine learning algorithm that uses multiple layers comprising of nonlinear units. Each layer uses the output of the previous layers as its input. Deep learning algorithms use more layers than shallow learning algorithms. Convolution neural network is classified as one of the deep learning algorithms. These networks are composed of multiple convolution layers with a few fully connected layers. They also make use of pooling; its configuration allows convolution networks to take advantage of bidimensional representation of data. Another deep learning algorithm is the recursive neural network. In this kind of architecture, the same set of weights is repeatedly applied over some data. Recurrent networks have shown good results in natural language processing.

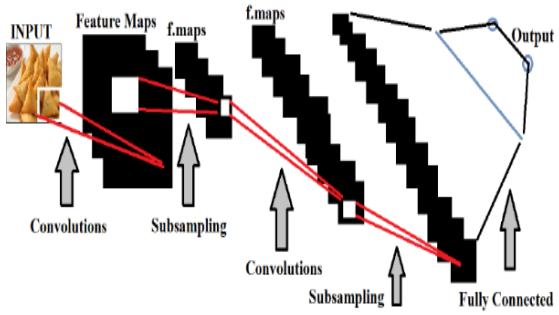

Fig 2: The Role of CNN

B. Neural Network Configuration:

A Google Inception V3 model(pre-trained on Image Net) is retrained. The construction of the neural network is shown in Fig. 3. The layers are:

1. AveragePool: An AveragePooling2D function is used (pool size (8,8)). This reduces variance in the data and reduces computational complexity as well. This layer flows the output into the next layer.

2. Convolution: A Convolution2D function is used (input size (299,299,3).This layer creates feature maps convolving input data to create feature maps.

3. MaxPool: A MaxPooling2D function is used. The pooling function reduces variance in the data and reduces computational complexity. Max pooling take out the most important features like edges whereas, average pooling extracts features smoothly.

4. Concat: The Concat layer is a utility layer that sequences its multiple input blobs to one single output blob. It loads a list of tensors as input, all of the same shape expect for the sequence axis, and returns a single tensor, the concatenation of all inputs.

5. Dropout: Dropout is a regularization technique for reducing overfitting in neural networks by preventing complex co-adaptations on training data. It is a very systematic way of performing model averaging with neural networks. The term ”dropout” mentions the

dropping out units (both hidden and visible) in a neural network. We have defined a dropout scale of 0.4.

6. Fully connected: Fully connected layers connect every neuron in one layer to every neuron in another layer. It is in idea the same as the traditional multi-layer perceptron neural network (MLP).

7. Softmax: Using Softmax function as an output function almost behaves like Max layer as well as it is differentiable to train by gradient descent. Exponential function will enlarge the probability of maximum value of the previous layer compare to other value. Also, aggregate of all output will be equal to 1.0 always.

C. Image preprocessing:

There are a few image preprocessing techniques used to acquire maximum efficiency from the proposed system. These preprocessing techniques ensure that any image taken from any angle will be able to get classified.

1. Image preprocessing parameters: The following are the parameters that are considered for image preprocessing.

a. Rotation range = 45: Images are randomly rotated by a degree of 45. This ensures that images taken at any angle can be forecasted correctly, and that diversity of the patterns obtained (feature maps) is maintained.

b. Width shift range = 0.2: Images are shifted horizontally by this fraction. This permits ”incomplete” or ”half” images to be forecasted, and patterns obtained will differ.

c. Height shift range = 0.2: Images are shifted vertically by this fraction of the total width. The cause is same as mentioned in horizontal shift.

d. Horizontal flip = True: Images are flipped horizontally. Random flipping of images helps in identifying different patterns and for ”upside down” images to be predicted accurately as well.

e. Fill mode = reflect: Points outside the boundaries of the images are filled according to this mode.

D. Image Processing to CNN:

The present work uses the Google InceptionV3 model [13] which is pre-trained on ImageNet. Prior to that, all theimages are reshaped to 299x299x3 size. The global average pooling function is applied on the dataset which takes theaverage of all features of an image. The dimensionality of output space is defined by using the dense() function. Thedropout fraction rate on input units with 0.5 is considered to avoid overfitting issues. Further, to determine the actualclass from n−number of classes softmax activation function is defined. It identifies the class based on the maximumprobability obtained at output for that class and ignores the rest.

E. Neural Network Training:

The simple CNN used for the proposed work is depicted in Fig. 2. The Stochastic Gradient Descent with a quicklydecreasing learning schedule has been used to achieve better performance. The model is trained for 32 epochs and consists of three callbacks defined which record the progress into a log file. A learning rate scheduler is defined as the which takes the epoch index as input and returns a new learning rate as output. Model checkpoints are made via the check pointer callback. These are saved in the form of .hdf5 files. The best score is taken to save only best learned models.

G. Dataset:

The dataset is generated by undertaking a white background behind the fruit, accomplished by placing a white sheet of paper as background. However, due to variations in the lighting conditions, the background was not constant. Fruits were ascend to fit a 160*160 pixels image. In the future, it is organised to work with different textured background and even larger image dimensions, as the practical simulation requires high-end processing units and multiprocessing architecture. The resulted dataset is used for training that consists of 2460 images of fruits roll out across 15 labels. Images are obtained by capturing fruits of different orientations.

4. SOFTWARE COMPONENTS

- COLAB: Colaboratory, or "Colab" for short, allows you to write and execute Python in your browser, with

  - Zero configuration
  - Required Free access to GPUs
  - Easy sharing

  Colab notebooks allows you to merge **executable code** and **rich text** in a single document, along with **images**, **HTML**, **LaTeX** and more. When you create your own Colab notebooks, they are kept in your Google Drive account. Colab notebooks are Jupyter notebooks that are provided by Colab.

- PYTHON(Version:3.7.6): Python is an interpreted high level, general purpose programming language.

- ANDROID STUDIO: It is an IDE for developing an android application.

5. HARDWARE COMPONENTS

- SMART PHONE (With Camera -2mp)

6. RESULTS

Input Output

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